Management of childhood diarrhoea at the household level: a population-based survey in north-east Brazil

F.C. Barros,[1] C.G. Victora,[1] B. Forsberg,[2] A.G.K. Maranhão,[3] M. Stegeman,[4] A. Gonzalez-Richmond,[5] R.M. Martins,[6] Z.A. Neuman,[7] J. McAuliffe,[8] & J.A. Branco Jr[3]

The management of childhood diarrhoea at the household level was studied in a population-based survey in four states in north-east Brazil. Of a representative sample of 6524 children under 5 years of age, 982 (15.1%) had diarrhoea on the day of the interview or had had diarrhoea at some time during the previous 15 days. A total of 66% of the children were not taken for treatment, while government health services were used by 14%, private doctors by 1%, and traditional healers (rezadeiras) *by 24%.*

Oral rehydration therapy was given to 24.3% of the children as follows: solutions of oral rehydration salts (ORS) were received by 6.8%, salt-and-sugar solutions by 14.7%, and solutions of commercial ORS brands by 4.3%. Although 95% of the caretakers knew about rehydration solutions, only 18% prepared them correctly, the most common error being the use of insufficient water.

Of the rehydration solutions used, 39% had a sodium concentration that was potentially dangerous (> 120 mmol/l), and 8% had a sodium concentration that was very low. Of those solutions prepared using ORS, 38% had too high a sodium concentration, while 14% of the salt-and-sugar solutions prepared using either the "scoop-and-pinch" approach or a plastic spoon were too concentrated. However, potentially the most dangerous were the salt-and-sugar solutions prepared using nonstandard recipes. More than half of these had an unacceptably high sodium concentration or osmolarity.

Introduction

National programmes for the control of diarrhoeal diseases have been operational in many countries for the last 10 years. Such programmes have usually focused on case management and in many instances have been successful in introducing oral rehydration therapy (ORT) to the communities they serve. Recent reports have indicated, however, that there are considerable difficulties in teaching the public how to prepare correctly oral rehydration solutions.[a] There are also indications that earlier surveys and studies overestimated the use of ORT,[b] and that the high usage levels after promotion campaigns have been difficult to sustain (*1*).

In order to collect data on the use and preparation of oral rehydration solutions in a community that had been exposed to health education on proper case management of diarrhoea, we carried out a household survey in north-east Brazil in April 1989. The study was preceded by the following efforts to disseminate knowledge about ORT: health workers from governmental and nongovernmental organizations were trained how to prepare and use oral rehydration solutions; a campaign for the use of home-made salt-and-sugar solutions (SSS) in the

[1] Department of Social Medicine, Universidade Federal de Pelotas, C.P. 464, 96.001 Pelotas RS, Brazil. Requests for reprints should be sent to Dr Barros at this address.

[2] Formerly, WHO Control of Diarrhoeal Diseases Programme. Present address: Department of International Health Care Research, Karolinska Institute, Stockholm, Sweden.

[3] Maternal and Child Health Division, Ministry of Health, Brasilia, Brazil.

[4] Pan American Health Organization, Brasilia, Brazil.

[5] United Nations Children's Fund (UNICEF), Brasilia, Brazil.

[6] Brazilian Society of Pediatrics, Rio de Janeiro, Brazil.

[7] Pastoral da Criança, National Conference of Brazilian Bishops, Curitiba, Brazil.

[8] Project Hope and Universidade Federal do Ceará, Fortaleza, Brazil.

Reprint No. **5146**

[a] **WHO Programme for Control of Diarrhoeal Diseases.** *Interim Programme Report 1988.* Unpublished document WHO/CDD/89.31.

[b] **WHO Programme for Control of Diarrhoeal Diseases.** *Sixth Programme Report 1986–1987.* Unpublished document WHO/CDD/88.28.

© World Health Organization 1991

treatment of diarrhoea was launched; and instructions on the preparation of the solutions, using either a pinch of salt and a scoop of sugar or a special plastic spoon for measuring the quantities of sugar and salt to be mixed in a glass of water, were broadcast daily on radio and television for several months preceding the survey. At the same time, the use of prepackaged oral rehydration salts (ORS), based on the WHO formulation, was also promoted on radio and television, and by the public health services. Efforts were made by the government to make ORS available in all public health facilities in the survey area, and several commercial brands of ORS were also sold in private drug stores and pharmacies.

Methodology

The nine states in north-east Brazil (total population, 41.3 million) were divided into four groups based on population size and geographical distribution. One state from each group was selected at random, and 10 municipalities were chosen at random in each state. Subsequently, eight sectors were selected randomly in each municipality and 30 households in each sector were surveyed using a standard technique that has been described previously.[c] If any child aged under 5 years had diarrhoea on the day of the survey or had had an episode of diarrhoea that started in the 15 days preceding the survey, a caretaker of the child was interviewed on the characteristics of the episode, how it had been managed, and whether the caretaker knew about ORT. If ORT had been given, the caretakers were asked to demonstrate how they had prepared the solutions that had been administered, and samples were taken for analysis.

The interviewers were qualified nurses or social workers who had undergone a week's training in the use of the questionnaire. Training included field practice and role-playing exercises. The four surveyors in each state were supervised by a coordinator throughout the 5 weeks of field work.

The results were weighted to take account of the different sampling fractions in each state and to reflect the urban–rural distribution of the population. Confidence intervals (CI) were calculated assuming a one-stage random sample of clusters (2).

Results

A total of 9467 households were surveyed and 6524 children under 5 years of age were identified. Of these children, 982 (15.1%) had diarrhoea on the day of the interview or had had diarrhoea that started within 15 days prior to the interview. Of the children with diarrhoea, 52% were males and 64% were aged under 2 years (Table 1). Altogether, 59% of the diarrhoea episodes occurred in rural areas, although only 46% of the population lived there. A large proportion (65%) of the caretakers had had less than 3 years of schooling.

Table 1: **Age distribution of children with diarrhoea in the study**

Age (in months)	% of children (n=982)
0–5	15
6–11	17
12–23	32
24–35	18
36–47	11
48–59	7
Total	100

The caretakers were asked where they had taken their children for treatment during the episode of diarrhoea. Government health services had been used by 14%, private practitioners by 1%, and traditional healers by 24%. Only 3% had gone directly to a pharmacy for advice, while 65% of the children had not been taken anywhere for treatment. Table 2 shows the distribution of use of health services, pharmacies, and traditional healers (*rezadeiras*) according to the child's age, area of residence, and maternal education level. Children under 1 year of age, those living in urban areas, and those whose mothers were not illiterate were more frequently taken for health care.

Table 2: **Proportion of children who used the different sources of health care, according to age, area of residence, and maternal education level**

	Source of care (% of children)		
	Health service	Pharmacy	Traditional healer
Age			
<1 year	19[a]	5[a]	38[a]
⩾1 year	12	2	17
Area of residence			
Urban	17[a]	3	21[a]
Rural	12	3	26
Maternal schooling			
None	10[a]	4	23
<3 years	15	3	24
⩾3 years	18	3	24

[a] $P<0.05$.

[c] *Diarrhoeal morbidity, mortality and treatment practices— household survey manual.* WHO unpublished document CDD/SER/86.2 Rev.1(1989).

Of the 982 study children, 871 were receiving food before the episode of diarrhoea started. During the episode, feeding was reduced or stopped for nearly half the children.

A total of 23% of the children were breast-fed and almost all (99%) had regularly received a liquid other than breast milk before the episode. Only 16% of breast-fed children reduced their intake of breast milk during the episode of diarrhoea. Compared with the situation that had prevailed before the episode, 23% (95% CI, 20.0–26.2%) of the children had an increased intake of liquids and 19% a reduced intake.

A total of 40.9% of the children received fluids during the diarrhoea episode. ORT was administered to 24.3% of the children (95% CI, 21.2–27.4%). Government-distributed packets of ORS were given to 6.8% (95% CI, 5.0–8.6%) of the children and SSS to 14.7% (95% CI, 11.9–17.5%). Of the latter children, 5% received SSS prepared using methods promoted by the campaign (either scoop-and-pinch or plastic spoon), and the remaining 9.7% were given any other home-made solution that contained salt and sugar. Commercial ORS was given to 4.3%. Of other fluids given as special treatment for diarrhoea, teas (>50 types were mentioned by caretakers) were the most common (17.5% of the children; 95% CI, 14.4–20.6%). Coconut-water (2.3%) and rice-water (1.1%) were rarely used. The use of ORT was more common the more severe the caretaker considered the episode to be (Table 3).

A total of 95% of the caretakers had knowledge of at least one of the rehydration solutions. Of the 189 caretakers who used ORS solutions, six demonstrated how they prepared them using the scoop-and-pinch method, 29 using a standard plastic spoon, 71 using an ORS package, and 83 using other recipes. Of the scoop-and-pinch users, only one correctly prepared the solution (the standards for correct preparation are given in the Annex). Of those who used a plastic spoon, only one mother (3%) correctly prepared the solution, including levelling the contents of the spoons. However, since the levelling procedure was not covered in the mass-media campaign, we also took as correct those instances in which the caretaker made a correct mixture but did not level off the spoons. When defined in this way, 11 (38%) of the caretakers prepared the solution correctly.

The most common error made in mixing was the use of insufficient water. Among ORS users, 44% used less than 800 ml of water for a packet that should have been diluted in 1 litre of water. For the solutions that were prepared using a plastic spoon, the amount of water used varied from 30 ml to 970 ml, with an average of 203 ml. Only 41% of the caretakers used 150–300 ml, the acceptable range.

In preparing SSS using the plastic spoon method, a further problem was that instead of the recommended two spoonfuls, only one spoonful of sugar was used by 41% of the caretakers. Among ORS users, 69% used the entire packet and 64% dissolved the contents completely.

A total of 67 recipes for SSS were demonstrated by the caretakers; these involved various ways of adding salt, sugar, and water, including the use of scoops, pinches, plastic spoons, teaspoons, and bottle caps.

After the caretakers had prepared the rehydration solution, a sample of it was collected for later determination of its sodium concentration and osmolarity; of the 189 solutions prepared, 173 were analysed. As shown in Table 4, 53% of the solutions had a sodium concentration of 30–120 mmol/l, and 41% an osmolarity of less than 300 mosmol/kg water. A total of 39% of the solutions had a sodium concentration that was potentially dangerous (>120 mmol/l).[d] Conversely, 8% of the solutions had a sodium concentration that was very low. In 38% of the cases, the ORS solutions had too high a sodium concentration, while 14% of the SSS prepared using one of the recommended recipes had too high a concentration of sodium. However, the potentially most dangerous solutions were the SSS prepared using nonstandard recipes, more than half of which

Table 3: **Use of oral rehydration solutions according to the caretaker's perception of the severity of the diarrhoea episode**

Solution[a]	Severity (% of children)			
	Low	Moderate	High	Risk of dying
ORS[b]	6	6	8	38
SSS				
Scoop-and-pinch or plastic spoon	5	6	3	13
Other home-made	9	8	11	30
Commercial ORS[b]	3	3	8	17
Any type of solution[b]	23	21	29	62
No. of children	577	203	185	16

[a] ORS = oral rehydration salts; SSS = salt-and-sugar solution.
[b] $P<0.05$.

[d] *A decision process for establishing policy on fluids for home therapy of diarrhoea.* Unpublished document WHO/CDD/SER/87.10.

Table 4: **Sodium concentration and osmolarity of the oral rehydration solutions prepared by the caretakers**

	Salt–sugar solutions:				
	Scoop-and-pinch	Plastic spoon (%)	Other home-made (%)	ORS (%)[a]	All groups (%)
Sodium conc. (mmol/l)					
<30	2/6	7	13	0	8
30–120	4/6	76	34	62	53
>120	0/6	17	54	38	39
Osmolarity (mosmol/kg water)					
≤300	6/6	62	36	32	41
>300	0/6	38	64	68	59
No. of samples	6	29	69	69	173

[a] ORS = oral rehydration salts.

had an unacceptable sodium concentration or osmolarity.

If the solutions prepared using nonstandard recipes are excluded, the sodium concentration of 66% of the rehydration solutions made by the caretakers fell into the acceptable range of 30–120 mmol/l, and 44% had an osmolarity of less than 300 mosmol/kg water.

The volumes of the rehydration solutions that were administered by the caretakers are shown in Table 5. On average, the intake of ORS was 354 ml over 24 hours, which was significantly greater than that for SSS. Children who were given a rehydration solution whose sodium concentration was less than 120 mmol/l ingested a significantly greater amount (average intake, 301 ml) than those who were offered solutions whose sodium concentrations were too high (average 218 ml, $P < 0.05$).

The sources of the caretaker's information on how to prepare the oral rehydration solutions, together with data on who prescribed the solutions, are shown in Table 6. Caretakers who had used SSS prepared with a plastic spoon had most often received instructions on diarrhoea treatment from a volunteer community health worker linked to the church (Pastoral da Criança). ORS users mostly mentioned a doctor as the primary source of information, while caretakers who prepared nonstandard recipes normally stated that they had obtained their information from television broadcasts.

Table 5: **Average intake by children given different rehydration solutions**

Type of solution	Mean ± S.D. (ml)	Range (ml)
Scoop-and-pinch	180 ± 70	60–230
Plastic spoon	227 ± 169	30–870
Other home-made	215 ± 188	15–765
ORS[a]	354 ± 269	22–1100
Total	270 ± 219	15–1100

[a] ORS = oral rehydration salts.

Discussion

The study examined the management of diarrhoea among 982 children under 5 years of age in north-east Brazil. Altogether, 63% of the children had not been taken anywhere for treatment during the episode of diarrhoea; public health services had been used by 14%, while the most common source of care was traditional healers (*rezadeiras*), to whom 24% of the children were taken.

These results are similar to findings in other countries, which indicate that caretakers often deal with an episode of diarrhoea on their own (*3*). Diarrhoea is considered an everyday event that is only a cause for concern if it gets worse. In the study, half of the caretakers who felt that the illness had put their children at risk of dying had taken them to public health services, while only 11% of those who considered the episode as mild had done so. Infants, who are usually considered to be more vulnerable by caretakers, were also taken more frequently than older children to the health services.

These findings reinforce the importance of home management of diarrhoea. They also confirm the results of other studies that have reported the important role played by traditional healers in the management of diarrhoea (*4*), and that such healers cannot be ignored by programmes for the control of diarrhoeal diseases.

During the episode of diarrhoea most of the caretakers gave their children at least the same

Table 6: **Data on who prescribed the oral rehydration solutions, and the source of information on how to use them, according to the type of solution**

	Salt–sugar solution:			
	Scoop-and-pinch	Plastic spoon (%)	Other home-made (%)	ORS (%)[a]
Prescribed by:				
Doctor	2/6	0	11	55
Another professional	0/6	17	1	21
Pastoral da Criança	2/6	34	4	3
Another person	0/6	17	15	7
Caretaker herself	2/6	31	66	14
Information source:[b]				
Television	1/6	7	42	0
Radio	1/6	0	16	0
Health services	2/6	21	10	76
Pastoral da Criança	2/6	45	10	3
Another person	0/6	14	15	10
Caretaker herself	1/6	10	16	6
No. of solutions	6	29	74	71

[a] ORS = oral rehydration salts.

[b] Total values might exceed 100% since multiple answers were accepted.

amount of breast milk, teas, and water as previously. However, almost half of the children received either no or less food, a pattern that has been observed in other countries.[e] This finding reinforces the significance of focusing health education on the importance of continued feeding during episodes of diarrhoea.

Although as many as 95% of the caretakers had heard of ORS or salt–sugar solution, only a quarter of the children had been given a recommended solution. Of these, around 10% had prepared mixtures that were probably based on recipes publicized in the mass media, but which were substantially different from those recommended. On the other hand, of the caretakers who used a standard recipe to prepare the rehydration solution, almost 80% mixed it incorrectly, use of too little water being the most common mistake.

Studies in other countries have also shown that problems in preparing oral rehydration solutions at the household level are common. In the Philippines it was found that a third of the caretakers who used ORS prepared it incorrectly, and this proportion was as high as two-thirds in the Sudan.[e] In contrast, in Bangladesh it has been reported that mothers can learn to prepare salt-and-sugar solutions if they are given intensive training (5). A survey in Vietnam in 1988 also showed that almost 90% of users of ORS or salt–sugar solutions could prepare them correctly (6). In both these cases the caretakers received their information through person-to-person communication. In the present study, most mistakes were made by the group that reported television to be their source of information on ORT. Health education through personal contact with the caretaker may therefore be the best way to ensure the correct preparation and use of oral rehydration solutions. Communication through the mass media can, nevertheless, be an estremely powerful way of promoting a product or of conveying a simple message to a large audience. Both these communication channels are important in ORT programmes and one cannot be substituted for the other.

During the survey, samples of solutions prepared by caretakers at home were collected and their sodium content and osmolarity determined; around 40% had a sodium concentration greater than 120 mmol/l, while 8% had a sodium concentration less than 30 mmol/l. Compared with salt-sugar solutions prepared using a plastic spoon or the scoop-and-pinch approach, solutions of ORS were more frequently too concentrated. However, the solutions prepared using nonstandard recipes were the most inaccurate. Clearly, confusion had arisen among the public because three methods of preparing oral rehydration solutions had been promoted.

[e] **WHO Programme for Control of Diarrhoeal Diseases.** *Seventh Programme Report 1988–1989.* Unpublished document WHO/CDD/90.34.

ORT campaigns should have a uniform message and promote only one recipe for the home preparation of rehydration mixtures. The choice of either home-made salt–sugar mixtures of prepackaged constituents should be based on an evaluation of the local conditions, taking into consideration principally the availability of the constituents and the safety of the solutions prepared. Health planners should bear in mind that both methods, if not properly taught, carry the risk that incorrectly prepared solutions are given to children. Of key importance is whether such solutions are dangerous in field situations. In the present study, children who were offered over-concentrated solutions drank significantly less of them than children who were given mixtures with the correct sodium content. This diminishes the risk of hypernatraemia among children taking rehydration solutions with too high a sodium content, and could be one explanation as to why there have been few reports of an increased incidence of hypernatraemia in countries where ORT programmes have been established, despite the documented evidence of problems in making up the solutions.

The above-mentioned problems should not be an obstacle to ORT programmes since their potential benefits far outweigh their risks. In a situation where only one-third of the world's children receive ORT, and maintaining feeding and administering adequate quantities of fluids to children with diarrhoea are worldwide problems, ORT programmes should be accelerated in all countries with high diarrhoea mortality rates. Such programmes should give equal weighting to the following basic messages regarding the caretaker's actions during an episode of diarrhoea: recognize and take action early; give adequate amounts of recommended home-made fluids; give frequent feedings and/or breast-feeding during diarrhoea and increased feedings during convalescence; and seek medical treatment in cases of severe or persistent diarrhoea.[1] Meanwhile, further research is needed on approaches to ensure that rehydration solutions are correctly prepared at home.

Acknowledgements

This study was supported by the WHO Diarrhoeal Diseases Control Programme and the United Nations Children's Fund (UNICEF).

[1] *Household management of diarrhoea and acute respiratory infections.* Report of a Scientific meeting at the Johns Hopkins School of Hygiene and Public Health in collaboration with UNICEF and WHO Diarrhoeal Diseases Central Programme. Baltimore, 1990.

Résumé

Traitement à domicile de la diarrhée infantile: une enquête de population dans le nord-est du Brésil

Le traitement à domicile de la diarrhée a été étudié lors d'une enquête de population dans quatre Etats du nord-est du Brésil. Dans un échantillon représentatif de 6524 enfants de moins de cinq ans, 982 (15,1%) avaient de la diarrhée le jour de l'entrevue ou en avaient eu à un moment quelconque pendant les 15 jours précédents. Un total de 66% des enfants n'avaient pas été vus pour traitement, alors que 14% d'entre eux avaient été conduits à un service de santé public, 1% à un médecin privé, et 24% à un guérisseur (*rezadeira*).

Un traitement par réhydratation orale a été donné à 24,3% des enfants comme suit: des solutions de réhydratation orale (SRO) ont été reçues par 6,8% des enfants, des solutions de sel et de sucre par 14,7% et des solutions commerciales de SRO par 4,3%. Si 95% des personnes donnant les soins connaissaient les solutions de réhydratation, 18% seulement les préparaient correctement, l'erreur la plus fréquente étant d'utiliser trop peu d'eau.

Sur les solutions de réhydratation utilisées, 39% avaient une concentration en sodium qui était potentiellement dangereuse (> 120 mmol/l), et 8% avaient une concentration en sodium très faible. Des solutions préparées à partir de SRO, 38% avaient une concentration en sodium trop élevée, alors que 14% des solutions de sel et de sucre préparées en utilisant la méthode "une poignée de sucre–une pincée de sel", ou au moyen d'une cuillère en plastique, étaient trop concentrées. Cependant, les solutions pouvant être les plus dangereuses étaient les solutions "sel et sucre" préparées en ne suivant pas les normes. Plus de la moitié d'entre elles avaient une concentration en sodium ou une osmolarité beaucoup trop élevée.

References

1. *Les maladies diarrhéiques dans le Sahel.* Dakar, PRITECH/ORANA, 1989.
2. **Bennet, S. et al.** A simplified general method for cluster sample surveys of health in developing countries. *World health statistics quarterly* (In press).
3. **WHO Diarrhoeal Diseases Control Programme.** Diarrhoea case management study. *Weekly epidemiological record*, **65**(4): 21–24 (1990).
4. **Nations, M.K. et al.** Brazilian popular healers as effective promoters of ORT and related child health strategies. *Bulletin of the Pan American Health Organization*, **22**: 335–354 (1988).

5. **Ellerbrock, T.V.** Oral replacement therapy in rural Bangladesh with home ingredients. *Tropical doctor*, **11**: 179–183 (1981).
6. **WHO Diarrhoeal Diseases Control Programme.** Comprehensive programme review. *Weekly epidemiological record*, **63** (39): 293–298 (1990).

Annex

Criteria for the correct preparation of rehydration solutions

• *Salt–sugar solution prepared with a standard plastic spoon (double-ended spoon with the end for salt being smaller than that for sugar)*

a) Two spoons (bigger end) of sugar.
b) One spoon (smaller end) of salt.
c) Mixed and well dissolved in 150–300 ml of water.

• *Salt–sugar solution prepared with scoop-and-pinch method*

a) One medium-sized scoop of sugar.
b) A three-finger pinch of salt.
c) Mixed and well dissolved in 150–300 ml of water.

• *Oral rehydration salt (ORS) solution*

a) The full content of one ORS package.
b) Mixed and well dissolved in 800–1200 ml of water.